# Region 8 MOUNTAIN-PLAINS CONSORTUMES

### **PROJECT HIGHLIGHTS**

## SDSU conducts jointed plain concrete pavement design and construction review

WA research study to enhance the performance of future jointed plain concrete pavements (JPCP) in South Dakota is underway at South Dakota State University. The goal is to increase pavement durability, improve ride quality and reduce construction cost. The research team is expected to develop optimized concrete mix designs for JPCP applications, evaluate the performance of different joint sealing materials and strategies under seasonal weather and precipitation conditions, determine the load transfer effectiveness of different dowel bar arrangements, and assess the effect of the curing compound application rate on slab curling and warping.

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SDSU graduate students installing joint instrumentation on U.S. Highway 212 west of Belle Fourche, SD

Several mix designs were tested for workability and durability in the materials laboratory at SDSU. The laboratory study resulted in the development of two mix designs incorporating 1.5" top aggregate size and ¼" blending chip aggregates to provide good workability at lower cement content. The proposed mix designs have been submitted to the South Dakota Department of Transportation for review and possible application in upcoming JPCP projects. In addition, the research team has been collecting data

(Concrete Pavement Design continued on page 4)



### CSU studies truck safety on rural highways in complex driving conditions

Studies at Colorado State University will examine factors that influence truck safety on rural roads to identify strategies to reduce the number and severity of multiple-vehicle and single vehicle truck crashes.

In the United States and other developed countries, road accidents cause more injuries and casualties than any other natural or man-made hazard. In addition to multi-vehicle crashes, large trucks are vulnerable to single-vehicle accidents (e.g. rollover, sideslip) under hazardous driving environments on rural highways. These hazardous environments include inclement weather (e.g. strong crosswind gusts, snow, rain, or ice) and/or complicated terrain (e.g. steep slopes or sharp curves). How to characterize the adverse driving conditions and their interactions with single-vehicle and multi-vehicle accidents has become a challenge. Partially supported by research funds from MPC, researchers at CSU have conducted a series of studies on looking into truck safety issues on rural highways in complex driving conditions.



The studies, conducted by Ph.D. student Feng Chen under the supervision of Dr. Suren Chen, include the following major parts: (1) developing a reliabilitybased single-vehicle accident simulation model; (2) conducting a multi-

Feng Chen

scale traffic safety study on the I-70 corridor in Colorado by looking at single-vehicle accidents and multi-vehicle accidents simultaneously; (3) developing a GIS-based interactive system to predict related safety risk and related cost; and 4) investigating the injury severity of truck drivers by looking into the different mechanisms of injuries caused by multi-vehicle and singlevehicle accidents separately.

The studies include analytical simulation, historical data analysis and GIS application,

crash risk analysis, injury severity analysis and associated cost analysis. Along with the field environmental data collection technique developed in a previous MPC study, a framework to conduct the systematic truck safety assessment and prediction has been established. With such a platform, additional studies can be conducted.

To date, three journal papers have been published related to the work and another is under review.

## Long term performance of FRP repair materials project underway

CSU researchers working with the Colorado Department of Transportation to investigate several issues preventing the more extensive application



of Fiber Reinforced Polymers (FRP) as a repair material to concrete bridges in Colorado.

The research team includes assistant professor of civil and environmental engineering Rebecca Atadero and M.S. students Doug Allen and Oscar Mata. FRP was used to repair the arch on the Castlewood Canyon Bridge southeast of Denver in the summer of 2003. Allen is working with CDOT to plan a field evaluation of the material on the bridge including testing the bond between the FRP and the concrete, removal of some FRP for laboratory testing, and thermographic imaging of the arch. This research fills a gap in current durability research as most durability investigations of FRP use accelerated conditioning in laboratory settings. Mata is working on laboratory experiments to answer questions about the effect of the deicing agents used by CDOT (magnesium chloride and potassium acetate) on the bond performance of FRP to concrete. The research project also includes literature review components and the development of design examples to help CDOT engineers make use of the versatile material.

## Colorado researchers test various fly ashes in soil-rubber mixes

CSU researchers studied the potential use of off-specification fly ashes to increase the shear strength and stiffness of an expansive soil-rubber (ESR) mixture. Researchers Antonio Carraro and Ethan Wiechert found that the shear strength and stiffness improvements imparted by the offspecification fly ashe is similar to or better than the improvements imparted by conventional Class C fly ash.

The off-specification fly ashes (so designated because they do not meet ASTM specifications for use in concrete) used included a high sulfur content fly ash and a high carbon content fly ash. A standard Class C fly ash was also used as a control fly ash to develop a basis for comparison of the effects of the off-specification fly ashes. The ESR mixture consisted of high-plasticity clay blended with 20% 6.7-mm granulated rubber (by weight).

The fly ash content required to develop pozzolanic (cement-like) reactions was determined based on the concept of lime fixation point and kept constant for all ESR-fly ash mixtures. At this selected fly ash content, ESR-fly ash mixtures were tested at a single relative compaction level and curing times of 7 and 14 days. Unconfined compression testing was performed on compacted specimens to validate the fly ash content selected and the effect of curing time on the development of pozzolanic reactions.



The effect of the fly ash type, curing time and mean effective stress was evaluated by performing isotropically consolidated undrained triaxial compression tests on saturated specimens at mean effective stress levels of 50, 100 and 200 kPa. Stiffness changes due to fly ash addition were evaluated during undrained compression. Large-strain stiffness was measured using conventional external displacement transducers. Very-small strain stiffness was evaluated from shear wave velocity measurements using a bender element apparatus.

### University of Utah research examines highway design exceptions

Researchers at the University of Utah are launching a research project to improve the efficiency of the highway design process when exceptions must be made to design standards.

The project marks the first time that assistant professor of civil and environmental engineering R.J. Porter is the principal investigator of a Mountain-Plains Consortium project. The project, "Safety Impacts of Design Exceptions in Utah," is also partially funded by the Utah Department of Transportation.



R.J. Porter

The research objective is to compare safety, measured by expected crash frequency and severity, on road segments where design exceptions were approved, to similar road segments where no design exceptions were approved. Research results will provide insights into the effectiveness of UDOT's current design exception preparation and approval process as well as whether deviations from some controlling criteria have different safety impacts than others. These insights have the potential to improve the efficiency of the design exception preparation and approval process, reducing project delay and costs. Results will also contribute to FHWA/UDOT risk assessment activities and will support UDOT's ongoing practical design initiatives.

(Highway Design continued on page 4)

#### (Highway Design continued)

Porter is an expert on the operational and safety effects of geometric design decisions. He is a member of the TRB Operational Effects of Geometrics Committee (AHB65), Chair of the TRB Subcommittee on Performance-Based Analysis of Geometric Design [AHB65(3)], and a member of the Future Directions Subcommittee of the Task Force on the Development of the Highway Safety Manual (ANB25T). He is serving as an invited expert panel member for NCHRP 20-05/42-04: Recent Geometric Design Research and Practice for Improved Safety, Operations, and Maintenance. He is also a registered professional engineer in Utah.

## NDSU researchers compare rural and urban child car seat placement



NDSU researchers found that children in rural areas are much more likely to be seated in the front seats of vehicles than children in urban areas.

Andrea Huseth

Researcher Andrea Huseth observed vehicles at urban and rural elementary schools

in North Dakota and found than more than a third of vehicles overall had children seated in the front seat, but the rates were much higher for vehicles observed at rural schools. She notes that seating children in the rear of vehicles has been shown to decrease the odds of being fatally injured in a motor vehicle crash by 36% to 40%. Although rear seating is safer, rates of children being front-seated remain high, especially for older children.

"While differences in traffic safety between rural and urban areas have been extensively researched, very little work has been done on rural/urban differences in child seat placement," Huseth said.

Huseth found that differences also exist among vehicle type, with children riding in pickup trucks more likely to be front-seated than children in any other type of vehicle. Interviews with parents indicated that, overall, parents were aware that seating a child in the rear of a vehicle is safer.

Parents gave several reasons for not having a child seated in the rear of a vehicle, including size of vehicle, number of children to be transported, differences in family guidelines, and ambiguous "rules" regarding child vehicle safety. Parents felt that child vehicle safety information should come from as many sources as possible. They were also concerned that the majority of information received regarding traffic safety focused more on much younger children, and that as their children aged, they tended to receive less and less information.

The study was limited in scope but provided enough information to suggest that future research should be conducted to determine why there are rural/urban differences in child seat placement.

#### (Concrete Pavement Design continued)

during the last two years from instrumented test sections of newly constructed JPCP in South Dakota. The test sections included in this study are located on Interstate 29, U.S. Highway 50 and U.S. Highway 212 in South Dakota.

The study is co-sponsored by MPC and the South Dakota Department of Transportation.

## Wyoming Rural Road Safety Program being implemented statewide

The MPC and the Wyoming Department of Transportation are facilitating the implementation of the Wyoming Rural Road Safety Program on a statewide basis. The program helps counties identify high-risk rural road segments and their corresponding safety countermeasures as an efficient and cost effective ways to improve highway safety.

Finding methods to improve the safety of the nation's rural roadways is very important. About 80 percent of the Nation's roadway miles are rural. However, many rural roads lack important safety features. Nationally, about 60 percent of traffic fatalities occur on rural highways. Twolane roads have the highest fatality rates per vehicle-mile of travel.

The University of Wyoming is providing technical help and training to counties interested in implementing the program. So far, the University of Wyoming has helped half of the 23 counties in Wyoming to implement the WRRSP. Multiple low-cost safety projects have been approved for funding on roads with the highest risk levels. Currently, 20 safety improvement projects around the state have been funded. Eventually, all counties in the state are expected to follow the five-step procedure developed in this study to identify their high-risk rural road segments and safety countermeasures.

When the program has been fully implemented, funding requests from all counties will be ranked by the Wyoming Safety Management System committee. In this way, the distribution of available funding will be optimized. The University of Wyoming will do a follow-up study in three years on all of the improved sections to determine the effec-tiveness of the program in reducing crashes and fatalities. Three years is the minimum required wait time after installation of safety improvements to get meaningful results on benefits.

The methodology developed in this project has been presented nationally at the Transportation Research Board Annual Meeting and the National LTAP Association Annual Meeting. In addition, workshops and presentations have been given in Wyoming and throughout the broader Mountain-Plains region. Other states can benefit from this procedure when they are considering the distribu-tion of their high risk rural road funding. North Dakota has already initiated a study similar to WRRSP.

This program has made \$1.5 million available for low cost safety improvements for local governments in the State of Wyoming. In addition, the program will provide a steady stream of funding for safety improvements on local roads in the future. Providing local governments with a potential funding source for safety improvements is very important in ensuring that safety is considered at the local level.

As part of the WRRSP, a statewide sign program for local governments is being implemented. Half of the counties in the state have submitted requests for signs at high risk locations. More than 1,800 signs will be purchased by WYDOT and distributed to counties for installation to provide advanced warning to the driving public at high crash locations. The Wyoming LTAP center will be conducting a follow-up study to quantify the effectiveness of all of these improvements.

"The program has truly been a success story, showing how Wyoming local governments can work closely with WYDOT and FHWA to improve the safety of rural roads across the state," notes Khaled Ksaibati, MPC program director for Wyoming and Director of the Wyoming Local Technical Assistance Program. "For the first time in the state of Wyoming, local governments can apply for safety funding by following a systematic procedure."

The University of Wyoming developed the Wyoming Rural Road Safety Program with funding by MPC and the Wyoming Department of Transportation (WYDOT) in cooperation with the Federal Highway Administration (FHWA). Program guidance was provided by a Local Road Safety Advisory Group with representatives from WYDOT, the Wyoming Local Technical Assistance Program, the Wyoming Association of County Engineers and Road Supervisors, the Wyoming Association of Municipalities, and FHWA.

The pilot phase of the research project involved data collection and participation from Carbon, Laramie, and Johnson counties. The data collected included historical crash data as well as field conditions. A five-step procedure was developed and applied in these counties. These five steps are:

- 1. Crash data analysis
- 2. Level I field evaluation

- Combined ranking to identify potential high risk locations based on steps 1 and 2
- 4. Level II field evaluation to identify countermeasures
- 5. Benefit/cost analysis

Crash data were analyzed to identify high-risk segments with proportionately higher crashes during a 10-year analysis period. A Level I field evaluation was conducted to identify deficiencies in geometric conditions and shoulders as well as pavement markings and signage. Roadway segments were ranked on a scale from 0 to 10 in 5 risk categories based on the results of the field evaluation. The five categories are:

- 1. General
- 2. Intersection and Rail Road Crossings
- 3. Signage and Pavement Markings
- 4. Fixed Objects and Clear Zones
- 5. Shoulder and ROW

Combined rankings based on crash data and field evaluations were used to identify segments with the highest potential crash risks. A comprehensive analysis was then conducted on each high-risk segment. The objective of this evaluation was to identify low-cost safety counter-measures for segments identified as high-risk locations. A benefit/cost analysis was performed to help identify the most costeffective safety measures.

As a result of this successful pilot study, the Local Road Safety Advisory Group approved the WRRSP procedure as a means of improving safety on rural roads in Wyoming. Once a county has completed the five-step procedure, it has the necessary information to develop plans to fund safety improvements using the High Risk Rural Road Program or other funding sources. WYDOT is funding some of the counties' safety requests, providing incentives for other Wyoming counties to establish their own local safety programs.

### **Research Projects (2010-11)**

### **Colorado State University**

Colorat	io state University	
MPC-339:	MEPDG Analysis Of ESR Subgrade Stabilized With Off-Specification Fly Ash	
MPC-340:	Long Term Performance of FRP Repair Materials	
MPC-341:	Off-grid MEMS Sensor Configurations for	
	Transportation Structures	
MPC-342.	Seismic Vulnerability Analysis of Bridges in	
0.012	Mountainous States	
MPC-3/3.	Laboratory Testing of Innovative Steel Bridge	
Wii C 545.	Designs	
	Designs	
North [	Dakota State University	
Assessmen	t of Planning Models for Indian Reservation	
Roads		
Railway M	odels for Educational Purposes	
MPC-344:	What Can We Learn About Making Driving Safer	
	for Teen Drivers from Crashes in Three Rural	
	States?	
MPC-345:	Systems Analysis to Improve Local Road Safety:	
	Phase I	
MPC-346.	Marginal Cost Pricing and Subsidy of Transit in	
	Small Urbanized Areas	
MPC-347.	Misinformation Contributing to Safety Issues in	
	Vehicle Restraints for Children	
MPC-3/8.	Transit Ridershin and the Built Environment	
MDC-340	Modeling Analysis and Evaluation of Urban	
WIF C-549.	Arterial Work Zone	
MDC-350.	Modeling and Evaluation of Traffic Signal	
WFC-550.	Proomption near Pailroad Crossings in Small	
	Urban Aroa	
MDC 256.	Truck Size & Weight Education	
	Freight Deilwey Treek Meintenense Cost Medel	
	Connecting Supply Chain International Engine	
MPC-358:	Flow	
MPC-359:	Regional Roadway Surface Management	
	Guidance Documents	
South Dakota State University		
south Bullow blute Oniversity		
MPC-305:	Jointed Plain Concrete (JPC) Design and	
	Construction Review-Year 3	

MPC-306: Optimization of Pavement Marking

MPC-315: Analysis of Compound Channel Flow with Two-

MPC-316: Mitigation of Corrosion in CRC Pavement-Year 2

MPC-351: Concrete Structure Design Alternatives for Rural

MPC-352: Evaluation of Ice Loads on Bridge Piers in South

Performance-Year 3

**Dimensional Models** 

State and Local Roads

Dakota

(Research Projects continued on Page 13)

### **EDUCATIONAL HIGHLIGHTS**

### SURTC Program Director launches mentor program for transportation students



Jill Hough, director of the Small Urban & Rural Transit Center within the Upper Great Plains Transportation Institute at NDSU, has matched up students from her Public Transportation course with industry mentors from across the

Jill Hough

country. NDSU is serving as the pilot university for the mentor program that will potentially be replicated nationally. Hough developed the program in response to calls from industry professionals for better workforce development within higher education.

Students will be able to gather valuable insight from their mentors regarding real-world transportation challenges. Hough believes the greatest value of the program is that students are gaining a true understanding of how the industry works, rather than simply a theoretical, textbook understanding. Mentors and students will discuss a variety of topics such as transportation policies, cost-effectiveness and efficiency, managing budgets, technology application, working with workers' unions, and meeting overall challenges to organizational management.

As part of the program, the students will participate in a roundtable discussion on "Higher Education and Workforce Development" at the 2011 American Public Transportation Association Bus and Paratransit Conference in May. The conference will also serve as an opportunity for the students to meet their mentors. The Mountain-Plains Consortium is sponsoring the students to attend the conference. Student-Mentor pairings include:

- Dilip Mistry and David Lee, General Manager of Connecticut Transit
- Mridula Sarker and Linda Bohlinger, Vice President of HNTB Corporation, an engineering consulting firm based in Kansas City.
- Elvis Ndembe and Robert Prince, Vice President of AECOM, a professional technical management firm based in Los Angeles that specializes in several areas including transportation. Prince was formerly the director of the Massachusetts Bay Transit Authority.







Elvis Ndembe

## **TLGC: Educating the future leaders of the transportation industry**



The Transportation Leadership Graduate Certificate (TLGC) program is an online graduate education program designed

to expand the breadth of transportation professionals' knowledge. Since its start in the spring of 2010, the TLGC program has drawn the interest of many transportation professionals and students from across the country. Recent marketing efforts have led to an increased interest in the program and TLGC administrators believe they will receive more program registrants as the TLGC's reputation grows.

(TLGC continued on page 8)

## Electronic submission launched for NDSU Scholarships

An electronic application process was launched early in 2011 for transportation scholarships offered by the Upper Great Plains Transportation Institute at NDSU. The Institute is offering five scholarships for current NDSU juniors and seniors to be awarded for the 2011-2012 Academic Year. Four of the scholarships are funded by the MPC.

The on-line application process has already attracted the attention of students and generated a record number of applications.

The Charles E. Herman Scholarship recognizes academic achievement and promotes the education of transportation students with a preference to women and minorities at NDSU. Funding for one \$2,000 scholarship is provided by the Charles E. Herman Scholarship Endowment Fund, NDSU Development Foundation.

The Paul E.R. Abrahamson Transportation Scholarship recognizes outstanding students at NDSU with an interest in the transportation and logistics of agricultural products. Funding for two \$1,500 scholarships is provided by the MPC through the University Transportation Centers Program of the U.S. Department of Transportation.

The Transportation Engineering Scholarship recognizes academic achievement and promotes the education of transportation students at NDSU. Funding for two \$1,500 scholarships is provided by the MPC through the University Transportation Centers Program of the U.S. Department of Transportation.

#### (TLGC continued)

NDSU serves as the administrative home for the program as well as being one of the universities to offer courses. A variety of core courses and elective courses are offered to those pursuing the certificate from NDSU and several other top universities across the country. Faculty members are excited to participate by offering classes online as a part of the TLGC curriculum.

The program is an initiative of the Regional University Transportation Centers with the goal of providing accessible, graduate-level education to busy transportation professionals or those in related disciplines with an interest in transportation. The certificate is endorsed by both private and public sector organizations.

### PUBLISHED RESEARCH REPORT

#### Development of Safety Screening Tool for High Risk Rural Roads in South Dakota (MPC-11-231)

Given the sparsely distributed crashes across various highway systems, researchers at SDSU designed an Empirical Bayes (EB) based sliding window technique within a spatial context. Authors Xiao Qin and Adam Wellner say that by examining roadway safety spatially, safety analysts are able to account for high-risk locations completely within longer predefined segments and locations, which may include multiple predefined roadway segments. Removing the dependence on predefined segmentation can also bring to the forefront safety issues previously ignored. The robustness of the EB method significantly improves the crash estimation accuracy. In conjunction with several different but complementary safety metrics, a complete view of rural highway safety performance can be presented. To ease the use of such a new technique, the South Dakota GIS Highway Safety Review (GIS-HSR) Tools was developed, which provides a data-driven approach toward identifying high-risk locations.

### **WORKSHOP & PRESENTATIONS**

### Faculty and students participate in TRB Annual Meeting

MPC faculty, staff and students participated in the Transportation Research Board's 90th Annual Meeting, held January 23-27 in Washington, D.C. With more than 4,000 presentations in nearly 650 sessions and workshops, the meeting addressed topics of interest to all attendees policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. The conference theme for 2011 was Transportation, Livability, and Economic Development in a Changing World.

George Huntington and Dr. Khaled Ksaibati, both of the University of Wyoming, authored "Unsealed Gravel Road Management System Programming and Data Management," which summarizes the processes a programmer or data manager should go through when assisting with implementing or upgrading an unsealed gravel roads management system (GRMS). To address this issue, eight dirt and gravel road maintenance tasks are proposed.

Huntington and Ksaibati also collaborated on "Unsealed Gravel Road Management: State of the Practice in American Counties," providing insights into the current state of unsealed dirt and gravel roads management, with a particular emphasis on the rural counties of the American west.

"Recycled Asphalt Pavement in Gravel Roads," written by Scott Koch, University of Wyoming, and Ksaibati, explored the use of recycle asphalt pavement as a dust suppressant on gravel roads.

Stephen Boyles, University of Wyoming, presented "Comparison of Interpolation Methods for Missing Traffic Volume Data" in a session focused on "Achieving Quality Traffic Data: Opportunities for Improvement."

Boyles, along with Ruoyu Liu and Promothes Saha of the University of Wyoming, wrote "Pricing Model for Rural Roadway Networks Incorporating Pavement Deterioration and Repair." The paper presented a model for roadway tolling in rural areas based on vehicle type to generate revenues for rural roadways.

Ksaibati, along with Burt Andreen and Cody Kalivoda of the University of Wyoming, authored "Establishing Default Speed Limits on Gravel Roads," which offered the findings of a study on gravel roads to determine if speed limits should be altered for safety.

"Development of Knowledge Tables and Learning Outcomes for the Introductory Course in Transportation Engineering," presented by Rhonda Young of University of Wyoming along with several other educators, describes the "core concepts" that should be covered in introductory transportation engineering courses. The hope is that these concepts will provide educators some guidance for course content.

"Subnetwork Trip Table Generation with Bush-Based Sensitivity Analysis," written by Boyles offers an approach for replacing a regional traffic network with a smaller network that contains the subnetworks and zones and the paper gives a cost estimating function for this.

Dr. Francis Ting, professor of Civil and Environmental Engineering at SDSU, presented "Simplified Approach to Generating Hydrographs and Estimating Probability of Scour Depth Exceedance for Pier Scour Predictions in Ungaged Streams Using the SRICOS Method." The paper was co-authored by graduate student Ryan Larsen, and Dr. Allen Jones.

Xiao Qin and Adam John Wellner, both of South Dakota State University, wrote "GISbased Highway Safety Metrics Implementation and Evaluation" in a session focusing on "Advancements in Quantification of Highway Safety Performance."

(TRB continued on page 10)

#### (TRB continued)

Qin, along with Soyoung Jung of the University of Seoul, South Korea and David A. Noyce of the University of Wisconsin-Madison, wrote "Modeling Highway Safety and Simulation in Rainy Weather." Their research comprehensively examined the safety impacts of rainy weather conditions on multi-vehicle crash frequency and severity and validated the impact on traffic operations through micro-simulation modeling.

"Cycle-by-Cycle Queue Length Estimation for Signalized Intersections Using Sampled Trajectory Data" presented by Qin and several others uses critical points that represent changing vehicle dynamics to propose an improved queue length estimation model based on trajectory data. Queue length estimation is important in measuring intersection performance.

Hesham Mahgoub, Ali A. Selim, and KC Pramod, of South Dakota State University, wrote "Quantitative Assessment of Local Rural Road Safety: Case Study." The paper looks at ways to improve the safety performance of local rural roads in South Dakota by analyzing the crash occurrence and potential safety treatments.

Qin and University of Wisconsin researchers Ghazan Khan, Andrea Bill and David Noyce authored "Comprehensive Safety Evaluation of Roundabouts in Wisconsin." The research aimed to use data to develop crash prediction models that can serve as guidelines and best practices for other states in understanding roundabout safety.

Dr. Peter T. Martin of the University of Utah and James Mulandi of Resource Systems Group, Inc. wrote, "Quantifying the Benefit of Retiming Traffic Signals Through Multiple Regression." Regression models were presented that can be utilized to estimate the benefit of retiming signals.

Milan Zlatkovic of the University of Utah, in conjuction with Martin and Aleksandar Stevanovi of Florida Atlantic University authored, "Predictive Priority for Light Rail Transit: University Light Rail Line in Salt Lake County, Utah." The paper assesses the operational implementation of predictive light rail priority strategies through micro-simulation.

North Dakota State University's Jeremy Mattson presented "Transportation, Distance, and Health Care Utilization for Older Adults in Rural and Small Urban Areas." His study estimates the impacts of transportation and travel distance on utilization of health care services for older adults in rural and small urban areas.

"Technology Adoption by Small Urban and Rural Transit Agencies," written by David Ripplinger and Bethany Brandt-Sargent of the Upper Great Plains Transportation Institute and Jill Hough of North Dakota State University, uses national survey data from transit agencies to better understand the use of technology in small urban and rural transit agencies.

"Front Seat Placement of Children Aged 12 or Younger Within Vehicles: Rural-Urban Comparison" by Andrea Huseth of the Upper Great Plains Transportation Institute analyzed rural and urban differences in child seat placement within vehicles. Results indicate significant differences.

Doctoral student Thanh Q. Le at the University of Utah presented "Freeway Mainline Safety Effects of Interchange Ramp Spacing." The paper was part of a workshop designed to examine the challenges of implementing geometric designs in the real world. R.J. Porter from the University of Utah discussed safety issues at the workshop.

Porter also presented "Exploring the Relationship between Macroscopic Speed Parameters, Road Geometrics, and Traffic Control: An Empirical Study during Low-Volume Conditions in Construction Work Zones. The paper examined the interaction of speed, road geometry, and traffic control in construction work zones.

### Transit and Sustainable Growth Conference scheduled for Utah



A Transit and Sustainable Growth Conference scheduled for June 5-7 in Utah will address how transit research can be mobilized to build processes that connect research initiatives to all aspects of transit and sustainable growth from customer expectation to system delivery. The conference will be

of interest to those that propose, commission, sponsor, deliver, and disseminate the benefits of transit research in the western United States.

The event will be held at the Snowbird Ski and Summer Resort, located in Cottonwood Canyon near Salt Lake City, UT. For more information or to register, go to https://umarket.utah.edu/ civilmarket and click the "Transit Conference" tab.

Speakers include Steven Burian, director of Academic Sustainability Programs at the University of Utah; Carlos Braceras, of the Utah Department of Transportation; Andrew Gruber of the Wasatch Front Regional Council; Timothy Harpst of Salt Lake City; and Mike Crandall, chief planning officer with the Utah Transit Authority. There will also be presentations by the representatives from the Colorado Department of Transportation and consulting companies. Students are invited to compete to present a poster at the conference.

Sponsors include the MPC, the University of Utah, the Utah Transit Authority and the University of Denver.

### **STUDENT ACTIVITIES**

## Ph.D. students teach operations management course at NDSU

NDSU transportation and logistics Ph.D. students, Steve Leon and Eileen Campbell, will each be teaching a section of the Operations Management course this semester for the NDSU College of Business. The course is an introduction to the operations function of business.

Leon stresses that all businesses "have operations as their central function" and many businesses have common objectives and problems. The course will provide students with the tools and understanding of operations concepts



Steve Leon

they need to be successful. Students will be challenged to develop an understanding of how operations decision making is related to other business functions.



Campbell is excited to help students understand the relationship between the environment and supply chains. Green supply chains are the focus of Campbell's dissertation, so she will aim to instill the importance of green supply chains in the minds of the students.

Eileen Campbell

Additionally, Leon says that no matter what career students hold in the future, the management techniques will be applicable and useful. He believes that teaching is an invaluable way to improve his "ability to impart relevant and practical knowledge" about operations management in ways that are easy for people to understand.

## NDSU students present at TRF conference

At the 52nd Annual Transportation Research Forum Conference held March 10-12, five NDSU transportation and logistics students presented papers.

Nimish Dharmadhikari presented "Agent-Based Model for Disruption of Intermodal Transportation." The paper focuses on the post 9/11 security challenges of marine vessels and ports as part of the global supply chain and the need for a response system in the event of terrorist activity.

"Resource Allocation Using Portfolio Theory: An Airline Perspective," authored by Steven Leon aims to develop a new approach to resource allocation by employing a risk mitigation model using portfolio theory in which diversification is used to minimize risk.



T&L Students (Pan Lu, Nimish Dharmadhikari, Jeremy Mattson, Steven Leon, Qing Liu, Eunsu Lee)

leelong (Peter) Chen's paper, "The Dynamic Impacts to SCM by Practicing Collaborative Transportation Management and Implementing RFID in the Railroad Industry," addresses how to reduce overall rail supply chain in transportation time and inventory control.

"Incorporating Pollution Effects in U.S. Container Ports Efficiency Analysis" was presented by Qing Liu. He analyzes the environmental efficiency and scale properties of the container ports.



Eunsu Lee, graduating spring 2011 and Junwook Chi, researcher Nick J. Rahall, II Appalachian Transportation Institute, Marshall University (former graduate student 2008 of T&L)

Eunsu Lee presented "Visualizing Path-Based Routes for Import Containerized Freights in U.S.," which proposes heuristic path-enumeration model for both trip generation and trip assignment dynamic programming in GIS for the large-scale networks.

Pan Lu, an NDSU Transportation and Logistics Ph.D. candidate, also attended the conference.

## NDSU student presents on global transportation issues

EunSu Lee, a Ph.D. candidate in transportation and logistics, presented on the topic of "Transportation for a Globalized and Multicultural Society" as part of NDSU's World iView Series sponsored by the Office of International Programs. Presenters are selected to address various global issues that impact NDSU and the Fargo-Moorhead community.

Lee emphasized how mobility and connectivity are important in the everyday lives of people. He discussed the transportation of freight as well as people around the world, touching on how globalization has changed transportation. To explain how transportation affects the lives of people in all cultures, Lee noted that people need transportation in order to have what are considered basic necessities: food, housing, and water. If the resources are not available in a particular location, then they must be transported via truck, rail or air. He also addressed how transportation affects issues such as labor migration, food costs, security concerns, and disaster relief.

## NDSU Ph.D. student presents work on flood transportation

Eunsu Lee, a Ph.D. candidate in Transportation and Logistics at NDSU, has been invited to present at the 2011 Geospatial Information Systems for Transportation (GIS-T) Symposium. Lee will present his research related to flooding in the Red River Valley of North Dakota and Minnesota, "Visualization for Transportation Network in Flood Region."

The study is unique in that it uses remote sensing datasets to create a three-dimensional (3D) transportation network for GIS application. The research includes bridges over the Red River and the interstate highways of I-29 and I-94 in the 3D model that estimates flooding over roadways. This visualization aids the public's understanding of flooding and transportation flow during a flood.

At the symposium, Lee will also attend workshops and presentations that will contribute to further research. The conference is sponsored by the American Association of State Highway and Transportation Officials, bringing together transportation students, government personnel and private industry leaders. The theme of this year's conference is "The Keystone of Transportation Information."

### Former MPC student leads Peace Corps initiative in Kenya

A former MPC student and graduate of CSU is teaching physics, math and life skills in Mahuru Bay, Kenya, as a Peace Corps volunteer. He is also putting his MPC experience to use in improving sanitation, water supplies and agriculture in the surrounding area.



**Turnbull-Grimes** 

Chris Turnbull-Grimes has launched the "Many Small People," initiative. To date the initiative's primary efforts have been directed at installing rainwater catchment equipment at area schools. As a result the schools have reduced the need to purchase water and the amount of clean water for drinking and sanitation has increased. The money saved from no longer purchasing water and the expected revenue generated from selling excess water will be used to purchase school supplies and provide scholarships for students.

Turnbull-Grimes is in the midst of a 27-month Peace Corps assignment. For more on his efforts, visit: http://www.manysmallpeople.org/current. html#rabwao

Turnbull-Grimes specialized in structural engineering in his degree programs. While at CSU, he was involved in MPC research to test crash barriers and to study alternative materials, such as wood, for those barriers.

#### (Research Projects continued)

#### University of Utah

Transit Conference

MPC-288: Utah Department of Transportation Traffic Operations Center Operator Training (TOC) MPC-360: Safety Impacts of Design Exceptions in Utah

#### **University of Wyoming**

Pilot-Scale Implementation of a Gravel Roads Management System

- MPC-353: Comparing Crash Trends and Severity in the MPC Region
- MPC-354: Geotechnical Limit to Scour at Spill-through Abutments
- MPC-355: Quantifying the Impact of Very High Heavy Vehicle Proportion on Rural Freeways

### **NEW STUDENTS**

### **Colorado State University**

Emily Budagher earned her BS in civil engineering from New Mexico State University in 2010. As a student, she was active in Chi Epsilon, the Civil Engineering Honors Society, and Tau Beta Pi, the engineering honors society. Budagher also worked for the



**Emily Budagher** 

New Mexico Department of Transportation for two summers evaluating pavement distresses. She is currently an MS student in Geotechnical Engineering at Colorado State University conducting research on "MEPDG Analysis of ESR Subgrade Stabilized with Off-Specification Fly Ash" under the supervision of Antonio Carraro.

### North Dakota State University



Luke Holt

Luke Holt, originally from Grafton, ND, has begun work in the Transportation and Logistics program. He attended Concordia College in Moorhead, MN, earning a B.A. in business management in 2008. Holt then attended NDSU, earning a B.S. in

industrial engineering and management in 2010. Holt's research interests include supply chain management, traffic operations, and agricultural logistics. After earning his Ph.D., Holt plans to join the faculty at an institution in North Dakota. Joshua Smith, a captain in the U.S. Army, is now enrolled in the Master of Managerial Logistics program. Originally from Torrington, WY, Smith completed a B.S. in criminal justice at Grand Canyon University in Phoenix, AZ, in 2002. His interest in



Joshua Smith

transportation and logistics has led Smith to pursue a degree at NDSU. In the future, he hopes to serve in the U.S. Army as a logistician.

### **University of Wyoming**



Justin Terfehr is from Cheyenne, WY, and will complete a B.S. in civil engineering in May 2011. As an undergraduate student Justin was involved in ASCE, TBP, and club Rugby. He will be pursuing an M.S. in civil engineering. Justin

Justin Terfehr

is currently a research assistant evaluating WYDOT's Research Center. Upon graduation Justin plans to work in Wyoming as a professional engineer.

Burton Andreen is from Casper, WY, and will graduate with a B.S. in civil engineering in May of 2011. He is currently pursuing a master's degree in transportation and is a graduate research assistant in transportation. He has



Burton Andreen

worked on validating automated data collection techniques for the measurement of shoulder slopes as well as developing default speed limits for Wyoming gravel roads. Currently he is working on a comprehensive safety project comparing Wyoming and North Dakota safety programs.

### FACULTY ACTIVITIES

## Wehbe recognized for excellence in research

Dr. Nadim Wehbe, professor of Civil and Environmental Engineering at South Dakota State University (SDSU), was named the College of Engineering 2010 Distinguished Researcher. On February 15, 2011 Wehbe was among 23 SDSU faculty members who were recognized at the annual SDSU Celebration of Faculty Excellence banquet for outstanding research, teaching and service.



2010 SDSU Distinguished Researchers and Scholars (Wehbe is second from left)

### Travel time paper published

"The Effects of Detector Spacing on Travel Time Prediction on Freeways," was published in the International Journal of Engineering and Applied Sciences. Authors are Piyali Chaudhuri, Peter Martin, Aleksander Stevanovic, Chongkai Zhu of the University of Utah Traffic Lab.

### Qin presents at annual GIS for Transportation Symposium

SDSU researcher Xiao Qin made three presentations at the 24th annual GIS for Transportation Symposium in Hershey, PA March 28-30. The event provides a forum for professionals interested in the design and use of geospatial information systems for transportation. It brings together individuals from education, the private sector, and all levels of government for a full day of workshops. Qin's presentations were:

- Real-Time Arterial Traffic Performance Measures Using GPS-Instrumented Vehicles
- Development of a Statewide Crash Map: Merging and Mapping State and non-State Crashes onto a Single Network
- GIS-Based Highway Safety Metrics Implementation and Evaluation

### Martin to participate in University Research Technology Transfer Day

MPC researcher Peter Martin of the University of Utah will participate in the University Research Technology Transfer Day April 6 in Washington D.C. The event is sponsored by USDOT's Research and Innovative Technology Administration and will be attended by U.S. Transportation Secretary Ray LaHood and other DOT leaders.

Each year DOT invests in university research that supports the department's strategic goals, and technology transfer efforts help ensure that these investments make ongoing positive impacts across our transportation system. The event highlights research products that have been or are in the process of being deployed into the marketplace or impacting policy.

Martin will present a poster entitled, "Distracted Driving – it's not only dangerous, but it adds to congestion," and highlights research at the University of Utah that shows how cell phone use contributes to congestion.

The study used a driving simulator, to capture the driving behavior of 36 students. This behavior was then modeled in a mathematical representation of a real traffic stream on a freeway. Results indicated that, when drivers conversed on a cell phone, they made fewer lane changes, had a lower overall mean speed and a significant increase in travel time in the medium and high density driving conditions. This driving behavior results in travel delay and increases the probability of accidents.

### Utah research on freeway and interchange safety to be presented in Greece

R.J. Porter and student Thanh Le will present their recent work on the safety effects of ramp and interchange spacing at the First International Conference on Access Management this summer in Athens, Greece. The paper, titled "Performance-Based Safety Evaluation of Requests for New Access or Modifications to Existing Access on Freeways," focuses on one aspect of access management: quantifying the safety effects of changes in ramp spacing expected to result from adding new access points or modifying existing access points on freeways.

## Utah faculty member becomes technical member of the NCUTCD

The Executive Board of the National Committee on Uniform Traffic Control Devices (NCUTCD) voted to appoint University of Utah assistant professor of civil and environmental engineering R.J. Porter as a Technical Member of the Markings Committee in January 2011. The "National Committee" is an organization whose purpose is to assist in the development of standards, guides, and warrants for traffic control devices and practices. The NCUTCD recommends to the Federal Highway Administration and to other appropriate agencies proposed revisions and interpretations to the Manual on Uniform Traffic Control Devices and other accepted national standards.

### Porter invited to speak at Canada's 3rd Annual International Conference on Urban Traffic Safety

University of Utah assistant professor of civil and environmental engineering R.J. Porter has been invited to give an extended presentation on geometric design, speed-management, visibilityenhancement techniques, multi-modal safety countermeasures, and work zone design on urban streets at the third Annual International Conference on Urban Traffic Safety April 17-21 in Edmonton, Alberta, Canada. The presentation will include a compilation of Dr. Porter's current and recent work for the National Cooperative Highway Research Program (NCHRP) and Federal Highway Administration (FHWA). The conference objective is to inspire novel ideas and innovative approaches to address the 21st century needs and challenges of urban traffic safety. Conference sponsors have graciously offered to provide full financial support for Dr. Porter's travel and stay in Alberta.

### CSU researcher presents paper in Norway on wood-concrete composite members

Wood-concrete composite members were the focus of a dedicated session at the International Timber Bridge Conference held in September 2010 in Lillehammer, Norway. CSU affiliate faculty member Jeno Balogh presented a paper on the testing and numerical modeling of wood-concrete composite beams and decks which included MPC research results on using reclaimed utility poles in timber-concrete bridges, as well as an update on the ongoing research on the fatigue behavior of such members. The MPC fatigue research conducted at CSU by Balogh and CSU assistant professor Rebecca Atadero is performed in coordination with work done at University of Sassari, Italy, and University of Stuttgart, Germany.

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